



**AES**  
Sustainability  
Consultants

# A GUIDE TO LIFE CYCLE ASSESSMENTS



# ABOUT US

AES Sustainability Consultants are based in Devon, with over 54 consultants working collaboratively with clients and project teams across the UK to provide planning and development advice that delivers unparalleled cost-certainty and value for the construction industry. AES provide a wide range of sustainability services covering the whole life cycle of a development, always striving to add value and simplify the process across all service offerings for our clients.

## What do we offer?

A comprehensive package of sustainability services that has national coverage.

- Sustainability / Energy Statements
- Energy Modelling (SAP/SBEM)
- BREEAM Sustainability Service
- Home Quality Mark
- Air Leakage Testing
- Thermographic Surveys
- Sound Testing
- Post Occupancy Evaluations
- Retrofit and MEES Assessments
- Overheating and Thermal Comfort
- Life Cycle Assessments
- Daylight Assessment for BREEAM

### TALK TO US TODAY

Find out more about AES Sustainability Consultants and how you could benefit

+ Call us on 01884 242 050  
+ Email us at [info@aessc.co.uk](mailto:info@aessc.co.uk)



# BREEAM CREDIT AREAS AND ASSOCIATED SERVICES

## 1. Energy Assessments (SAP/SBEM):

- Ene 01 - Reduction of Energy Use & Carbon Emissions
- Ene 04 - Low Carbon Design (Passive Design & LZC Feasibility Study)

## 2. Overheating/Thermal Comfort:

- Hea 04 - Thermal Comfort
- Ene 04 - Low Carbon Design (Passive Design)

## 3. LCA:

- Mat 01 - Environmental Impacts from Construction Products - Building LCA
- Mat 02 - Life Cycle Cost and Service Life Planning

## 4. LZC:

- Ene 04 - Low Carbon Design (LZC Feasibility Study)

## 5. Daylighting analysis:

- Hea 01 - Visual Comfort (Daylighting and View Out)

## 6. Air Leakage Testing:

- Ene 01 - Reduction of Energy Use & Carbon Emissions
- Man 04 - Commissioning & Handover (Testing & Inspecting Building Fabric)

## 7. Thermographic Surveys:

- Man 04 - Commissioning & Handover (Testing & Inspecting Building Fabric)

## 8. Sound Testing:

- Hea 05 - Acoustic Performance
- Pol 05 - Reduction of Noise Pollution

## 9. Passive Design Analysis:

- Ene 04 - Low Carbon Design (Passive Design)

## 10. BREEAM AP

- Man 01 Project & Design (BREEAM AP - Concept & Developed Design)
- Man 03 Responsible Construction Practices (BREEAM AP - Site)

# OUR TEAM



## Claire Stone

Claire specialises in energy efficient building services and renewable technology integration. Claire has worked on a range of projects including industrial, defence, education and residential. Claire also has experience in different modelling processes, including IES and overheating.



## Katie Townley

Prior to joining AES Katie was a BREEAM Assessor and Accredited Professional who also has experience of undertaking both DREAM and LEED, and GLA assessments working on a range of projects including multi-residential, industrial, and bespoke developments.



## Dora Rebola

Dora has worked as an architect in the building industry for several years before a transition to sustainable consultancy. She specialises in Sustainability Certification, Life Cycle Assessment and Life Cycle Costing, and GLA Assessments, for both international and UK based projects.



## Cece Koczias

Cece has worked as a sustainability consultant, working on projects all over the UK, completing over 25 projects. She is trained to conduct Life Cycle Assessments, Whole Life Carbon Assessments, Life Cycle Costing and DREAM Assessments.

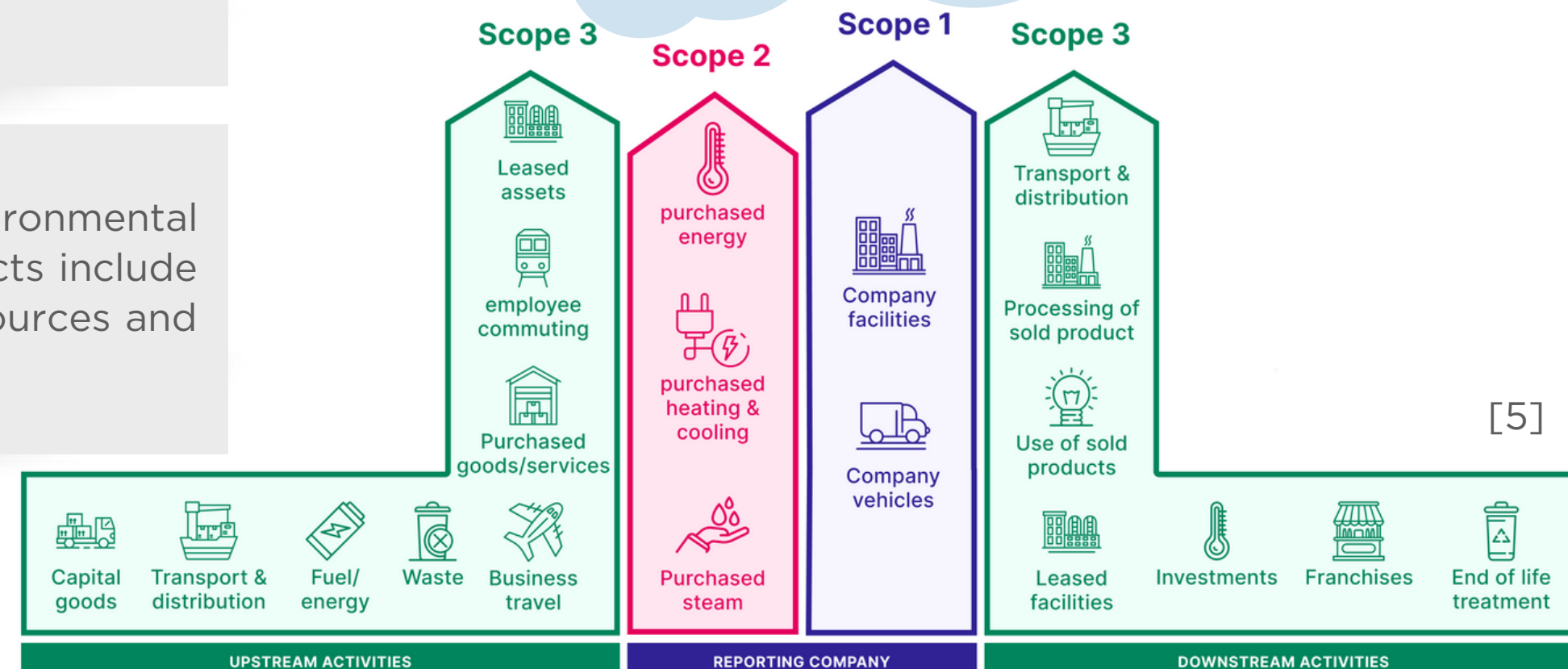
# ABSTRACT

The construction sector is responsible for up to 50% of the global carbon dioxide emissions [1]. In the United Kingdom buildings and infrastructure contribute 25% to the total UK greenhouse gas emissions. If the transportation (vehicle emissions) is included within the scope of the built environment, the total share of the UK emissions increases to 42% [2].

Life Cycle Assessment (LCA) is an important tool in helping us to understand the lifetime impacts of buildings and can help calculate Scope 3 carbon emissions facilitating a strategy for emissions reduction [3].

In order to create an environmentally conscious building, the environmental impacts of it's entire service life must be known. Environmental impacts include emissions into the environment and the varying consumptions of resources and land use, distribution and processing [4].”

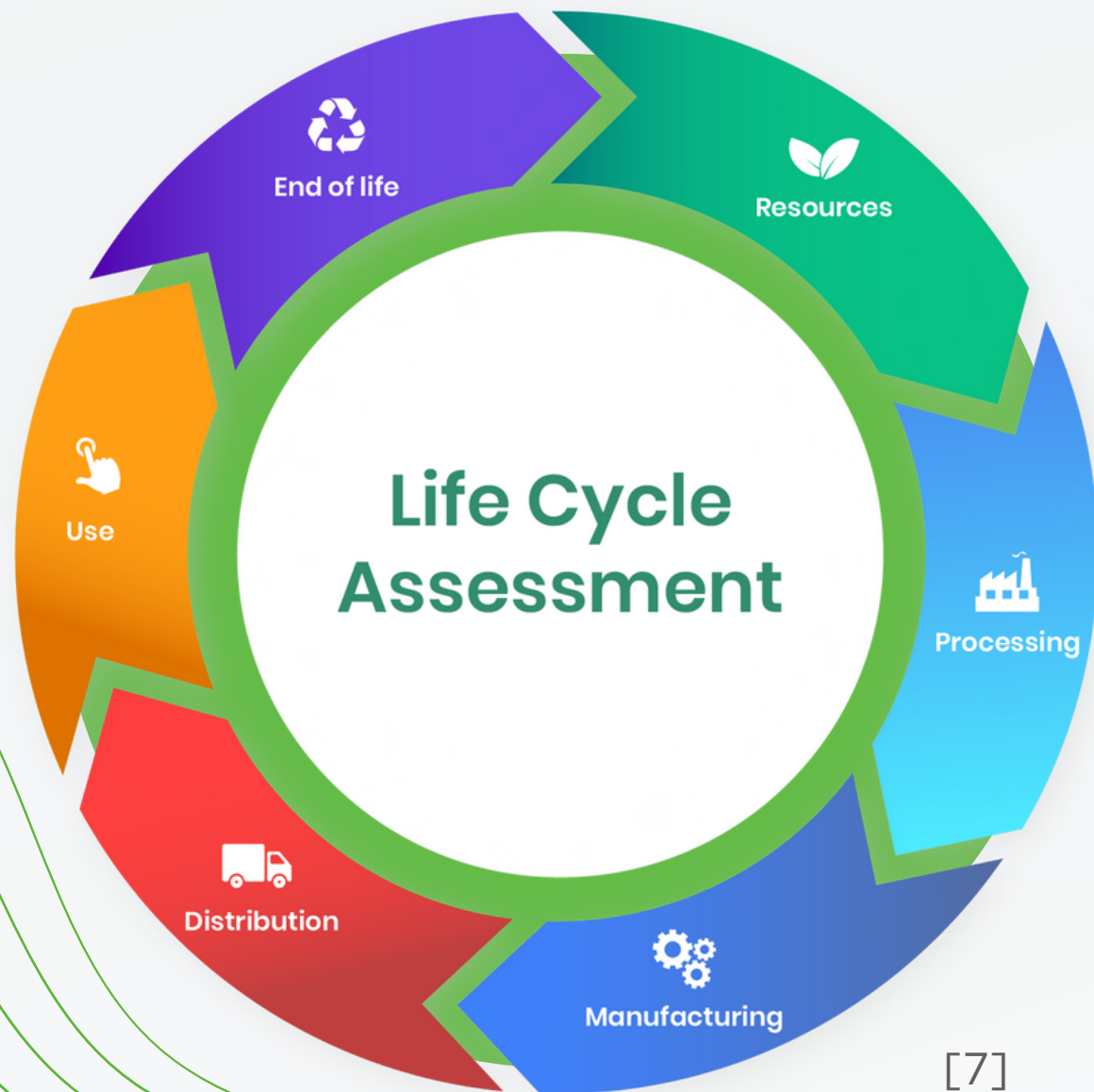
## Emissions



# WHAT IS A LIFE CYCLE ASSESSMENT?

The life cycle assessment of buildings seeks to expand the boundaries of construction sustainability. Rather than simply examining operational energy demand and associated emissions, this methodology allows a sustainability appraisal to incorporate the impact associated with the extraction of raw materials, the manufacturing process, transport, application and the energy used in recycling or replacement of the material at end of life.

Increasingly it is being demonstrated that as operational energy demand of buildings is being reduced through the energy efficiency provisions of the Building Regulations, in-use energy demand is accounting for a decreasing proportion of the overall Whole Life Cycle (WLC) energy and CO<sub>2</sub> emissions. As such, the necessity for consideration of the embodied carbon of construction is becoming more apparent to continue to reduce the climate impacts of the built environment [6].



[7]

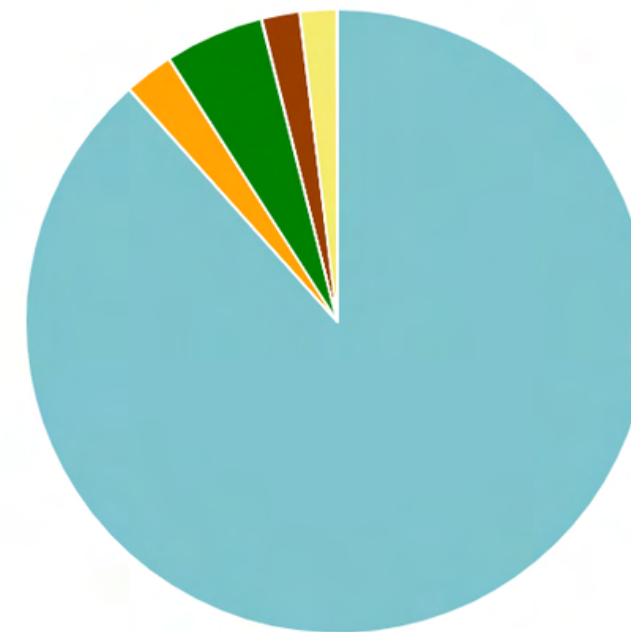
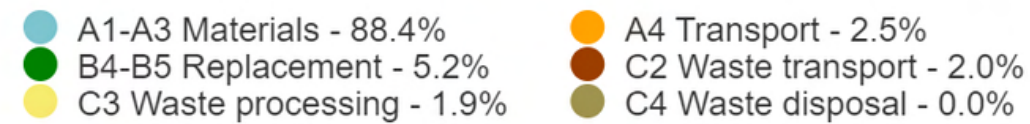


# LCA AND BREEAM

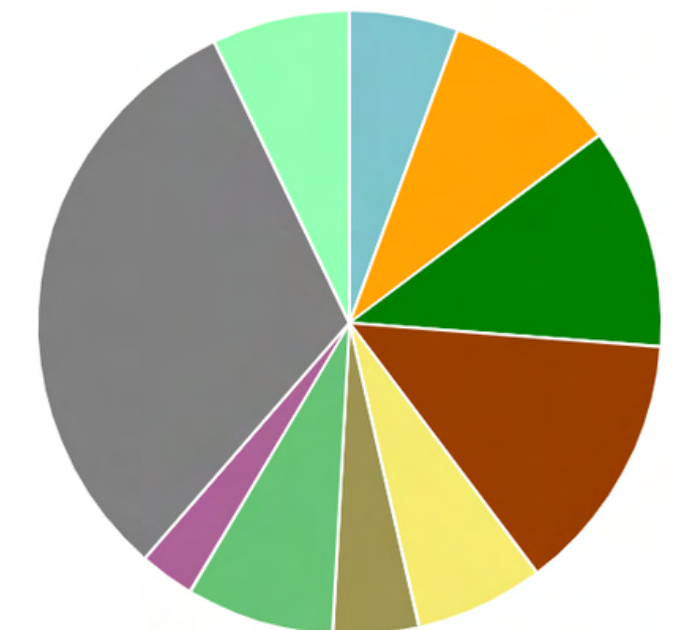
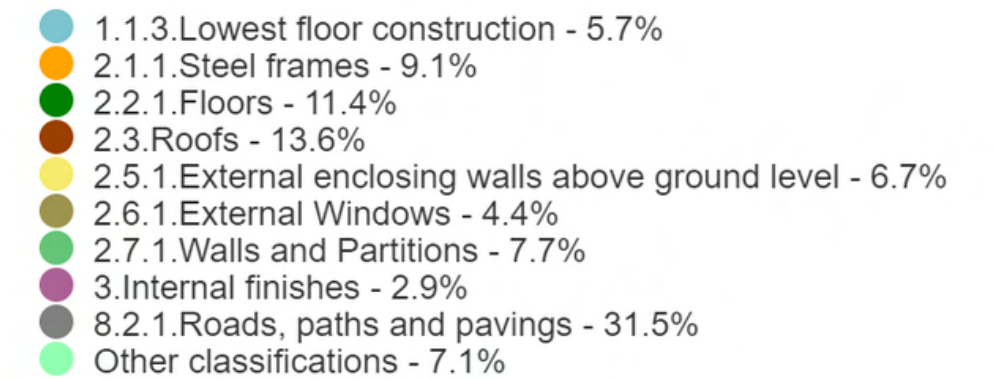
Under BREEAM assessments, LCA is one of the most important credits. Credit Mat 01 is worth up to 6 credits plus an exemplary credit. This is done with the BREEAM Mat 01 calculator by reporting the life cycle greenhouse gas emissions (kgCO<sub>2</sub>e) for each building element based on a 60-year building lifetime [8].

This methodology takes a building element approach where the elements that need to be assessed are defined by building type, for example offices, retail, industrial etc.

## Global warming kg CO<sub>2</sub>e - Life-cycle stages



## Global warming kg CO<sub>2</sub>e - Classifications



# ELEMENTS INCLUDED

01

02

03

04

## SUPERSTRUCTURE

Frame, Upper Floors, Roof, Stairs and Ramps, External Walls, Windows, Walls and Partitions (Education Only)

## SUBSTRUCTURE

Standard and Specialist Foundations, Lowest Floor Construction, Basement Retaining Walls

## EXTERNAL WORKS

Roads, Paths and Pavings

## SERVICES

Heat Source, Space Heating, Air Conditioning, Ventilation, Fuel Installations and Systems



# ONE CLICK LCA

One Click LCA is a BREEAM compliant software, tailored to achieving the targeted BREEAM credits, including life cycle stages, impact indicators, benchmarking and more.



Module A1 to A3 includes the provision of all materials, products and energy as well as waste processing up to the end of waste state or disposal of final residues during the product stage.



Module A4 and A5 include impacts and aspects related to any losses during construction process stage (i.e. transport, installation, waste disposal and processing etc.).

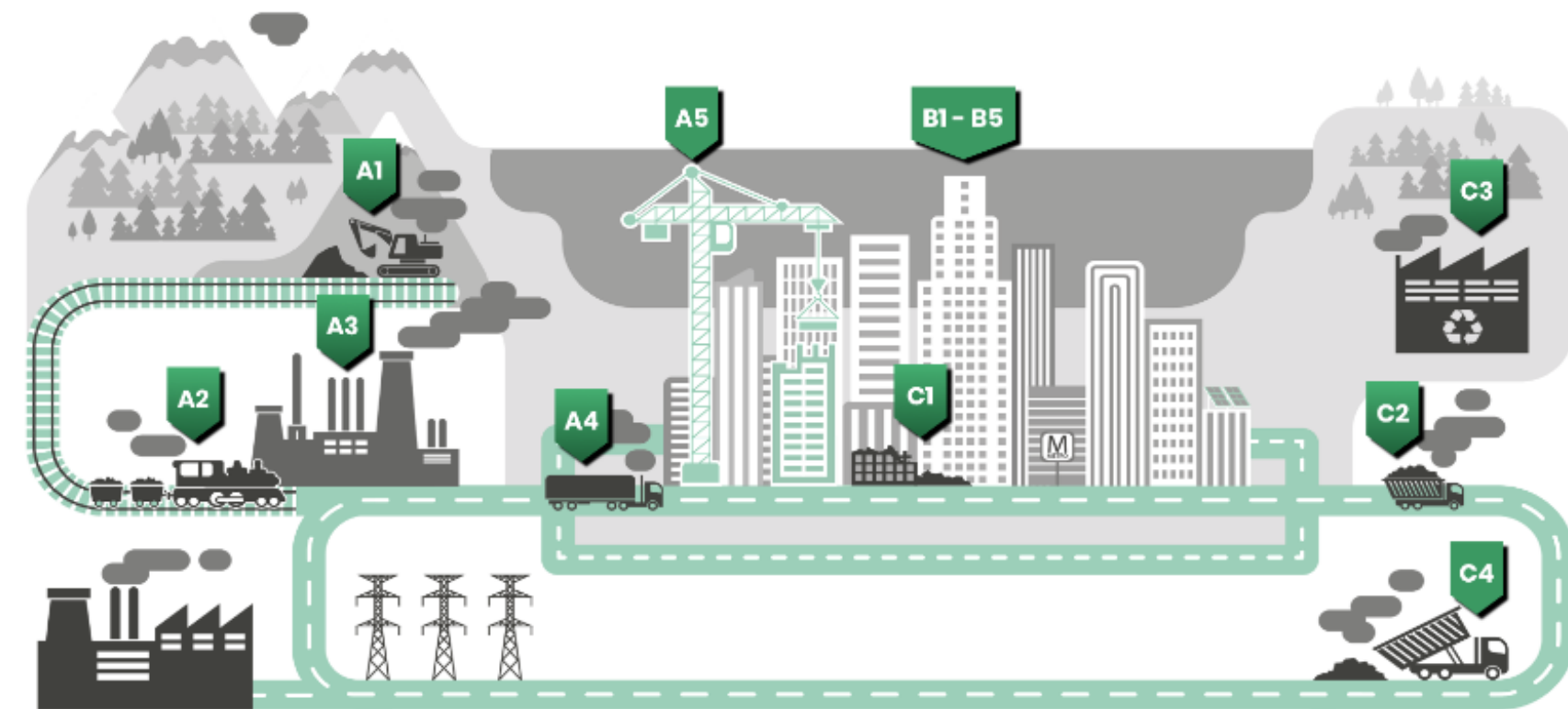


Module B6 and B7 also include provision and transport of all materials, energy and waste provisions, waste processing up to the end-of-waste state or disposal of final residues during this use stage.



All C modules include provision and transport, provision of all materials, products and related energy and water use.

## Sources of embodied carbon across the construction lifecycle



### A1 - A3 Product stage

- A1 Raw material extraction
- A2 Transport to manufacturing site
- A3 Manufacturing

### A4 - A5 Construction stage

- A4 Transport to construction site
- A5 Installation / Assembly

### B1 - B5 Use stage

- B1 Use
- B2 Maintenance
- B3 Repair
- B4 Replacement
- B5 Refurbishment

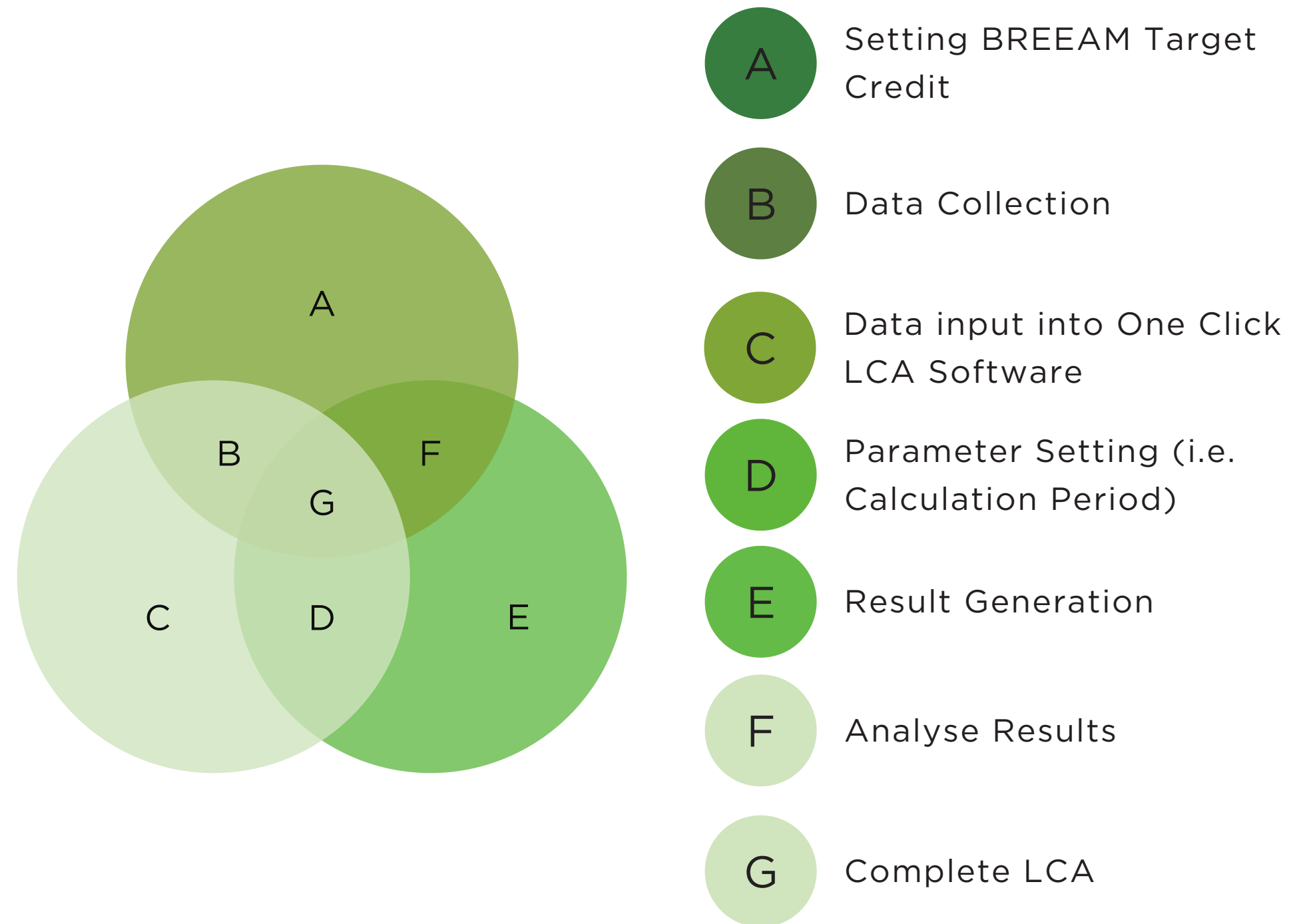
### C1 - C4 End of life stage

- C1 Deconstruction & demolition
- C2 Transport
- C3 Waste processing
- C4 Disposal

# OUR PROCESSES

The calculations present in our completed LCA reports are created through careful and attentive data collection in cooperation with the architects, mechanical engineers and structural engineers involved in the project. A complete Life Cycle Assessment, depending on the scope, will have accounted for all modules from A1 Construction Materials to C4 End of Life.

With the use of One Click LCA software we generate the mandatory materials and in-scope items, finding the most appropriate material inputs that are in scope and in the interest of the project, as well as the targeted BREEAM Credit.



# CASE STUDY: CALCOT PARK - CLUB HOUSE



The development consists of the new building construction of a Clubhouse to the existing Calcot Park Golf Club, Bath Road, Reading, RG31 7RN.

## Involvement

Appointed at early Concept Design and prior to planning to undertake the Stage 2 Life Cycle Assessment (LCA) in line with BREEAM UK New Construction 2018 Credit Mat 01 - Environmental Impacts from Construction Products. The purpose of the analysis was to model the environmental impact of various material options for the proposed building with the aim of aiding the decision making process, allowing for the full lifespan of the constituent materials to be appraised.

## Added Value

AES worked closely with the design team to not only achieve the targeted BREEAM credits, but to also deliver a building that achieves long term cost savings, pushes the boundaries of sustainable buildings and reduces the building's embodied carbon through the identification of an end-to-end product life cycle.

# REFERENCES

- [1] Raynsford, N., 1999. The UK's approach to sustainable development in construction. *Building Research & Information*, 27(6), pp.419-423.
- [2] UK GBC. 2023. Climate Change.
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- [4] Sharma, A., Saxena, A., Sethi, M. and Shree, V., 2011. Life cycle assessment of buildings: a review. *Renewable and Sustainable Energy Reviews*
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- [6] Sansom, M. and Pope, R., 2012. A comparative embodied carbon assessment of commercial buildings. *The Structural Engineer*.
- [7] One Click LCA. 2023. A guide to Life-Cycle Assessment for Green Building Experts.
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- [9] One Click LCA. 2023. Decarbonizing construction.

